MONASH University
Information Technology

FIT5167
Natural computation for intelligent systems

Unit Guide

Semester 1, 2012

Last updated: 24 Feb 2012

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FIT5167 Natural computation for intelligent systems - Semester 1, 2012

This unit looks at the development and application of biologically inspired models of computation. We study: basic components of a natural neural systems: synapses, dendrites and neurons and their computational models; fundamental concepts of data and signal encoding and processing; neural network architectures: pattern association networks, auto associative networks, feedforward networks, competitive networks, self organizing networks and recurrent networks; plasticity and learning. Hebb rule, supervised learning, reinforced learning, error-correcting learning, unsupervised learning, competitive learning, self-organization.

Mode of Delivery

Caulfield (Evening)

Contact Hours

2 hrs lectures/wk, 2 hrs laboratories/wk

Workload

Two-hour lecture and two-hour tutorial (or laboratory) (requiring advance preparation) a minimum of 2-3 hours of personal study per one hour of contact time in order to satisfy the reading and assignment expectations. You will need to allocate up to 5 hours per week in some weeks, for use of a computer, including time for newsgroups/discussion groups.

Unit Relationships

Prohibitions

CSE5301

Chief Examiner

Dr Grace Rumantir

Campus Lecturer

Caulfield

Grace Rumantir, Consultation hours: Monday 2-4pm

Tutors

Caulfield

Minh Viet Le, Consultation hours: Tuesday 9-10am

Academic Overview

Outcomes

At the completion of this unit students will:

- understand basic computational principles underlying the operations of biological neural systems;
- have knowledge of computational methods of simulating biological and artificial neural systems;
- have knowledge of supervised, unsupervised and self-organising neuronal learning systems;
- be able to use computer software to simulate behaviour of neurons and neural networks.

Graduate Attributes

Monash prepares its graduates to be:

1. responsible and effective global citizens who:

a. engage in an internationalised world
b. exhibit cross-cultural competence
c. demonstrate ethical values

critical and creative scholars who:

a. produce innovative solutions to problems
b. apply research skills to a range of challenges
c. communicate perceptively and effectively

Assessment Summary

Examination (3 hours): 60%; In-semester assessment: 40%

Assessment Task	Value	Due Date
Unit Test	20%	Unit Test during Week 7 lecture (Monday 16 April 2012)
Applications of Neural Network Algorithms	20%	Assignment Stage 1 during Week 9 tutorial, Assignment Stage 2 due start of Week 11 lecture (Monday 14 May 2012)
Examination 1	60 %	To be advised

Teaching Approach

Lecture and tutorials or problem classes

This teaching and learning approach provides facilitated learning, practical exploration and peer learning.

Feedback

Our feedback to You

Types of feedback you can expect to receive in this unit are:

- Informal feedback on progress in labs/tutes
- Graded assignments with comments
- Interviews
- Test results and feedback
- Quiz results
- Solutions to tutes, labs and assignments

Your feedback to Us

Monash is committed to excellence in education and regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through SETU, Student Evaluation of Teacher and Unit. The University's student evaluation policy requires that every unit is evaluated each year. Students are strongly encouraged to complete the surveys. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

For more information on Monash's educational strategy, and on student evaluations, see:
http://www.monash.edu.au/about/monash-directions/directions.html
http://www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

Previous Student Evaluations of this unit

This unit is offered for the first time in Semester 1 2010.

If you wish to view how previous students rated this unit, please go to
https://emuapps.monash.edu.au/unitevaluations/index.jsp

Required Resources

Please check with your lecturer before purchasing any Required Resources. Prescribed texts are available for you to borrow in the library, and prescribed software is available in student labs.

You will need access to a Neural Network tool such as:

- Matlab 2009a with Neural Network Toolbox
- Weka (available free from http://www.cs.waikato.ac.nz/ml/weka/)
- Emergent (available free from http://grey.colorado.edu/emergent/index.php/Main_Page)
- SNNS (available free from www.ra.cs.uni-tuebingen.de/SNNS)

All the above softwares are available in the 24 hour labs B3.45, B3.46, B3.46b at the Caulfield Campus. Submit an online IT request to gain access to these labs at
http://www1.infotech.monash.edu.au/webservices/servicedesk/requestform/

Examination material or equipment

Scientific Calculator

Unit Schedule

Week	Activities	Assessment
0		
1	Introduction	There is a self-assessed test (not marked) on basic maths and statistics on Moodle that will be discussed in Week 1 tute. Please complete this to see if you need to do further study prior to completing this unit.
2	Artificial Neural Networks: an Overview	
3	Perceptron for Linear Pattern Classification	
4	Neural Networks for Non-linear Pattern Recognition 1	
5	Neural Networks for Non-linear Pattern Recognition 2	
6	Generalisation and Improving Neural Networks Performance	
7	Unit Test (in the lecture time slot - tute still on)	Unit Test during Week 7 lecture
8	Unsupervised Classification with Self Organising Maps	
9	Associative Memory Networks	Assignment Stage 1 during Week 9 tutorial
10	Neural Networks for Time series Forecasting	
11	Recurrent Networks for Time series Forecasting	Assignment Stage 2 due start of Week 11 lecture
12	Revision	
	SWOT VAC	No formal assessment is undertaken SWOT VAC
	Examination period	LINK to Assessment Policy: http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html

*Unit Schedule details will be maintained and communicated to you via your MUSO (Blackboard or Moodle) learning system.

Assessment Requirements

Assessment Policy

Faculty Policy - Unit Assessment Hurdles
(http://www.infotech.monash.edu.au/resources/staff/edgov/policies/assessment-examinations/unit-assessment-hu

Assessment Tasks

Participation

- **Assessment task 1**

  Title:
  Unit Test
  Description:
  Closed-book unit test to be conducted in the lecture time slot in Week 7.
  Weighting:
  20%
  Criteria for assessment:
  Correct answers to questions and quality of solutions to problems which demonstrate understanding of the learning materials. Further detail of the format and coverage of the unit test will be made available on Moodle.
  Due date:
  Unit Test during Week 7 lecture (Monday 16 April 2012)
  Remarks:
  The Unit Test will be conducted during the Week 7 lecture time slot. Week 7 tutorials will still run as per normal.

- **Assessment task 2**

  Title:
  Applications of Neural Network Algorithms
  Description:
  Students are to build neural network models for a given data set and provide analysis thereof.
  Weighting:
  20%
  Criteria for assessment:
  The assignment will be in paired groups.

  Stage 1: Group formation and understanding the assessment tasks (non assessable).

  Stage 2: Submission (20%).

   Students will be assessed on:

  - ♦ The degree to which the submission meet the assignment specification.
  - ♦ The quality of the data preprocessing and the design of experiments.
  - ♦ How well the experiments are conducted and summarised.
  - ♦ How well the results of the experiments are analysed and documented.

The tutor will monitor individual contributions when allocating marks to members of the group.

Further assessment criteria and marking sheet will be made available on the unit Moodle site.

Due date:

Assignment Stage 1 during Week 9 tutorial, Assignment Stage 2 due start of Week 11 lecture (Monday 14 May 2012)

Remarks:

The assignment is to be submitted at the start of the Week 11 lecture. Penalty for late submission applies.

Examinations

- **Examination 1**

Weighting:
60 %
Length:
3 hours
Type (open/closed book):
Closed book
Electronic devices allowed in the exam:
Scientific Calculator

Assignment submission

It is a University requirement (http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-procedures.html) for students to submit an assignment coversheet for each assessment item. Faculty Assignment coversheets can be found at http://www.infotech.monash.edu.au/resources/student/forms/. Please check with your Lecturer on the submission method for your assignment coversheet (e.g. attach a file to the online assignment submission, hand-in a hard copy, or use an online quiz).

Online submission

If Electronic Submission has been approved for your unit, please submit your work via the VLE site for this unit, which you can access via links in the my.monash portal.

Extensions and penalties

Submission must be made by the due date otherwise penalties will be enforced.

You must negotiate any extensions formally with your campus unit leader via the in-semester special consideration process: http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html.

Returning assignments

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Other Information

Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:
http://policy.monash.edu.au/policy-bank/academic/education/index.html

Key educational policies include:

- Plagiarism
  (http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html)
- Assessment
  (http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-pc
- Special Consideration
  (http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.h
- Grading Scale
  (http://www.policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html)
- Discipline: Student Policy
  (http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-discipline-policy.html)
- Academic Calendar and Semesters (http://www.monash.edu.au/students/key-dates/);
- Orientation and Transition (http://www.infotech.monash.edu.au/resources/student/orientation/); and
- Academic and Administrative Complaints and Grievances Policy
  (http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.
- Codes of Practice for Teaching and Learning
  (http://www.policy.monash.edu.au/policy-bank/academic/education/conduct/suppdocs/code-of-practice-tea

Student services

The University provides many different kinds of support services for you. Contact your tutor if you need advice and see the range of services available at www.monash.edu.au/students. For Sunway see http://www.monash.edu.my/Student-services, and for South Africa see http://www.monash.ac.za/current/

The Monash University Library provides a range of services and resources that enable you to save time and be more effective in your learning and research. Go to http://www.lib.monash.edu.au or the library tab in my.monash portal for more information. At Sunway, visit the Library and Learning Commons at http://www.lib.monash.edu.my/. At South Africa visit http://www.lib.monash.ac.za/.

Academic support services may be available for students who have a disability or medical condition. Registration with the Disability Liaison Unit is required. Further information is available as follows:

- Website: http://monash.edu/equity-diversity/disability/index.html;
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1 Gallery Building (Building 55), Monash University, Clayton Campus, or Student Community Services Department, Level 2, Building 2, Monash University, Sunway Campus
- Telephone: 03 9905 5704, or contact the Student Advisor, Student Commuity Services at 03 55146018 at Sunway

Other

Recommended Reading

- S. Samarasinghe, *Neural Networks for Applied Sciences and Engineering: From Fundamentals to Complex Pattern Recognition*, Auerbach Publications, 2007 (e-book from Monash Library)
- G. Dreyfus, *Neural Networks: Methodology and Applications*, Springer-Verlag Berlin Heidelberg, 2005 (e-book)
- R. Beale, *Neural Computing: an Introduction*, Institute of Physics Pub., Bristol, 1991 (e-book)

- S. Haykin, *Neural Networks and Learning Machines*, 3rd edition, Prentice Education , Inc., New Jersey, 2009
- C. Bishop, *Neural Networks for Pattern Recognition*, Oxford University Press, 2005
- J. Freeman and D. Skapura, *Neural Networks: Algorithms, Applications, and Programming Techniques*, Addison-Wesley, Massachussets, 1991